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(54) Probe for corrosion testing

(57) A probe for corrosion testing includes a spirally wound resistance element (13) on a rod shaped insulating member 12 which is reinforced by an electrically conductive rod member 11. The element is partially covered by a moulded portion 19 which therefore shoulds part of the element, the remainder of the element being exposed. The exposed end of the element 13 is connected to the rod at 14. The other end of the element 13 and the rod 11 are respectively connected to electrical conductors 16,17. The central part of the element is connected to a further conductor. The conductors 16,17 and 15 are used to connect the exposed and unexposed parts of the element 13 to a bridge network whereby the resistance of the exposed element part can be monitored.

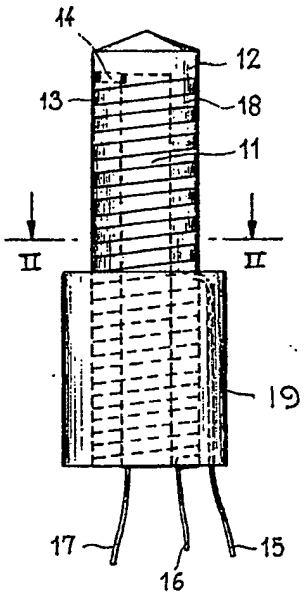

FIG 1

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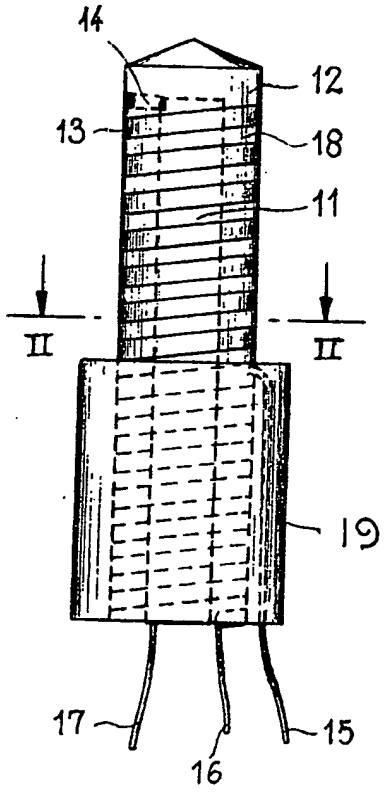

FIG 1

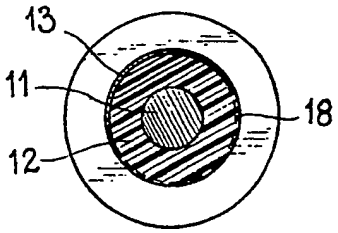

FIG 2

SPECIFICATION

Probe for corrosion testing

This invention relates to a probe for the testing or monitoring of the effects of a corrosive environment involving providing a corrodable resistance element which is helically arranged on an electrically insulating support. The probe is intended to be permanently installed in the region at which the corrosive environment occurs. Such location can be in the wall of a pipe, tank or other structure in which corrosive conditions are likely to occur.

Probes for testing for corrosion are used in various forms of equipment, installations and structures, e.g., in systems, more particularly offshore systems, for processing petrochemical products. The active components of such probes are preferably prepared from an active metallic material that is similar to that used in the equipment etc., to be protected, e.g, the material of the tank or pipe wall. The probes are fitted with screw type threads so that they can be screw mounted to the location of use in such manner that the active part of the probe is in contact with the same medium as the equipment itself i.e., the medium being transported through the pipe or contained in the tank. In practice, the active part of the probe is connected to a remotely located electrical measurement circuit.

One form of such measurement equipment involves resistance bridge network arrangements in which the electrical resistance of the exposed active metallic part of the probe which is exposed to the corrosive conditions is compared with the resistance of a similar non-active part of the probe which is not exposed to the corrosive conditions.

In use of such probes it is found that decrease in the area of the active element i.e., the corroded element causes the electrical resistance to increase and present a measure of the corrosion of the equipment concerned. Such probes are generally termed "electrical resistance probes" or ER probes. Such ER probes may have an additional resistance element with the same properties as those of the active element, but sealed from the influence of the corrosive envoironment and thereby acting as a reference element, whereby during the balancing procedures of the bridge network a desirable temperarure compensation can be achieved.

British Patent No 1,402,413 discloses a probe having a helical conductive element arranged on an electrically non-conductive, rod shaped core. It has been found that this known construction exhibits certain shortcomings as a consequence of the nature of the core material together with the use of a separate electrical conductor for the connections for each end of the resistance element thereby complicating the mounting of the probe.

Furthermore, it has been found that the conductive element is liable to be attacked in particular by corrosion occuring in the fissures created between the core and the conductive element which corrosion has been found to lead to erroneous measurements being made by the probe.

Figure 2 is a section on the line II-II of Figure 1.

Referring now to the drawing a probe includes a cylindrical support rod 11 of steel or other electrically conductive material having corresponding physical properties. A sheathing 12 of a synthetic material which is preferably elastomeric and which is electrically insulating encloses the main part of the rod 11 including one end thereof.

The insulating sheathing 12 which can have an cylindrical external surface so that the sheathing is effectively a hollow cylinder is such that the rod may be firmly embedded therein. The sheathing carries a helically or otherwise spirally wound or arranged strip 13 of a carbon steel or other metallic material depending upon the material of the pipe wall, tank or other structure at the location at which the corrosion is to be tested or otherwise monitored. The strip 13 has a pitch which is larger than the width thereof thereby leaving the surface of the sheathing exposed along a helical space or passage lengthwise of the sheathing 12 which is electrically insulating.

The end of the strip 13 adjoining the closed end of the sheathing is electrically connected to the one end of the central rod 11 as is indicated at 14. The centre of the strip 13 is connected to an electrically insulated wire 15, while the other end of the strip 13, adjoining the other end of the rod 11 is connected to an electrically insulated wire 16. An electrically conductive wire 17 is connected to said other end of the rod.

It is a primary object of the present invention to provide an improved probe of the kind above discussed and to produce a probe which is particularly suitable for mounting in the wall of a pipe or tank and which makes use of comparative electrical measurements whereby the changes in ambient conditions such as temperature may be compensated.

According to the present invention there is provided a probe for testing corrosion, including an electrical resistance element of a corrodable material, the resistance element being spirally arranged upon the surface of an electrically insulating support member, an electrically conductive reinforcement member for internally reinforcing the support member, means for enclosing or shrouding a portion of the length of the support member and thus a corresponding portion of the length of the resistance element including one end thereof thereby effectively to separate the resistance element into an unexposed portion including the element one end and an exposed portion including the other end of the element, an electrical connection between said other end of the resistance element and the reinforcement member, and means for enabling connection of a measuring circuit to the reinforcement member, and said one end of the resistance element.

For a better understanding of the invention and to show how to carry the same into effect reference will now be made to the accompanying drawing in which:

Figure 1 is a side view of an embodiment of a probe incorporating the features of the invention; and

The electrically insulating space or passage defined between the adjacent turns of the strip 13 is filled-in or otherwise covered by an electrically insulating material 18, such that the outer surface of the material 18 is flush or level with the spiral outer

surface of the strip 13, whereby the outer surface of the probe presents an initially uniform diameter.

The portion of the strip located between said one end and the location of the connection of the wire 15 with the strip 13 is enclosed by a housing 19 which effectively shrouds or encloses the surface of this portion of the strip 13. The housing 19 is preferably moulded such as to ensure that a sealed bond is made with the carrying structure 13, 18. In a modified embodiment, the strip 13 is provided with its carrying and covering parts by a moulding process. With this embodiment the necessary electrical connections are prepared prior to the moulding process.

The housing 19 is provided partly to shroud a portion of the strip 13, and partly to facilitate the mounting of the probe in a wall, e.g., a pipe or tank. For this pupose the housing 19 can be provided with threads (not shown) or otherwise made suitable for mounting in an opening, such as a bore or a bushing.

The wires 15,15 and 17 are connected to a resistance bridge type of measuring circuit (not shown) in such manner as to enable the use of the exposed and nonexposed portions of the strip 13 as the unknown and reference resistances of a measuring bridge. Thus the exposed outer part of the strip 13 forms the unknown resistance whilst the covered part will provide the reference element of the bridge.

It will be appreciated that the rod 11, in addition to functioning as an electrical conductor acts as a reinforcement for the probe.

The diameter of the active part of the probe shown may be 10-30mm and the length of the protruding, active part 10-100mm. The required suitable physical properties of the materials in any particilar aplication may be readilly determined of a person skilled in the art. Furthermore, the srrip 13 is preferably prepared from a material with resistance to corrosion corresponding to that of the structure to be tested.

The length of the strip 13 may be 400mm, its width 3mm and its depth 1mm.

The probe may be modified, e.g., in regard of the method of manufacturing, its dimensions, it shape of section, and the selection of the materials. Such modifications are considered to be within the scope of the invention as defined in the accompanying claims.

CLAIMS

1. A probe for testing corrosion, including an electrical resistance element of a corrodable material, the resistance element being spirally arranged upon the surface of an electrically insulating support member, an electrically conductive reinforcement member for internally reinforcing the supprot member, means for enclosing or shrouding a portion of the length of the support member and thus a corresponding portion of the length of the resistance element including one end thereof thereby effectively to separate the resistance element into an unexposed portion including the element one end and an exposed portion including the other end of the element, an electrical connection between said other end of the resistance element and the reinforcement member, and means for enabling connection of a measuring circuit to the reinforcement member, and said one end of the resistance element.

2. A probe as claimed in claim 1, wherein the resistive length of the enclosed part and that of the exposed portions of the element are equal.

3. A probe as claimed in claim 1 or 2, wherein an electrically insulating mateterial is provided between adjacent turns of the resistance element, the arrangement being such that the surface of the exposed portion of the resistance element is flush with the surface of the insulating material.

4. A probe as claimed in claim 1,2 or 3, wherein the support and the covering means are moulded from a synthethic elastomeric material as an integral element.

5. A probe as claimed in claim 1,2,3 or 4, wherein the covering means is adapted for mounting the probe in the wall of a vessel or pipe or the like at a location where the corrosion is to be tested in such manner that the exposed portion of the resistance element projects into the corrosive environment.

6. A probe for testing corrosion constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

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